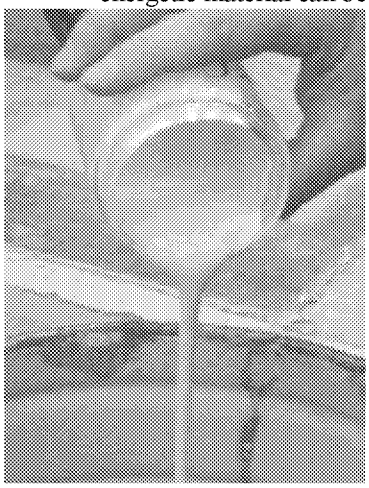
RAW ENERGETICS PROCESSING AND DIRECT PUMPING OF ENERGETIC WASTES

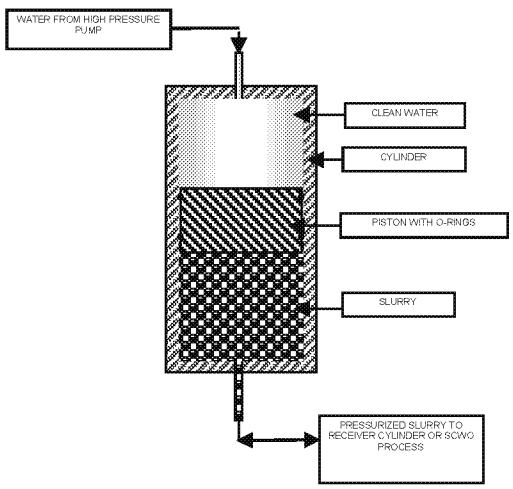
General Atomics (GA), the Air Force Research Lab (AFRL/MLQL), Safety Managements Systems Inc, (SMS) and ATK Thiokol recently completed a successful series of processing and high pressure pumping tests utilizing downloaded energetic materials. The primary goal of these tests was to demonstrate that energetic material can be particle size reduced, slurried and pumped at the elevated pressures associated with supercritical water (SCWO) processing.



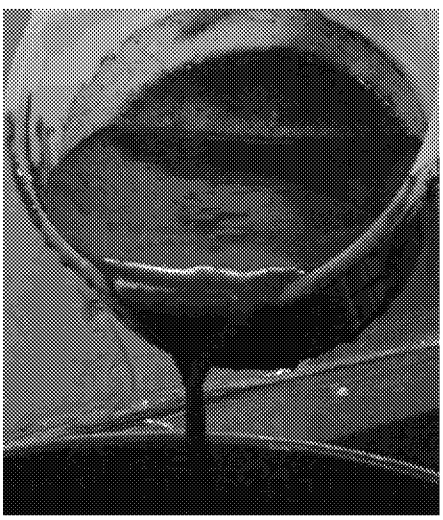
25 wt% TNT Slurry

The testing was performed at ATK Thiokol utilizing GA designed and fabricated equipment. SMS performed in-process energetic characterization testing (e.g., sensitivity, reactivity and particle size evaluations) and created the preliminary hazards analysis that guided the design and fabrication of the equipment utilized in the program.

The equipment utilized in the processing and pumping tests included a high speed grinder/pump unit, GA developed syringe pump technology and commercially available mixers, high and low pressure valving and tubing and fittings. The slurry processing and pumping equipment was skid mounted and designed to operate remotely and un-attended for extended durations.



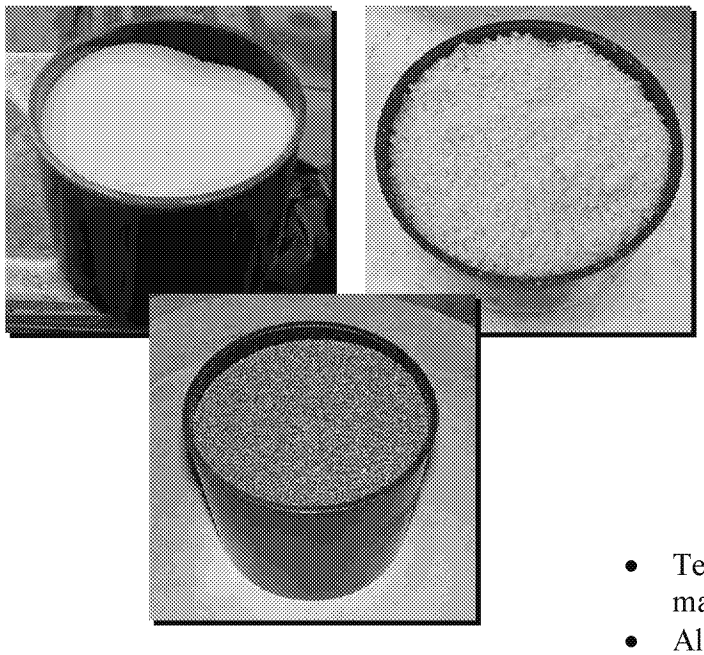
GA Syringe Pumping Technology



20 wt% WC-872 Slurry

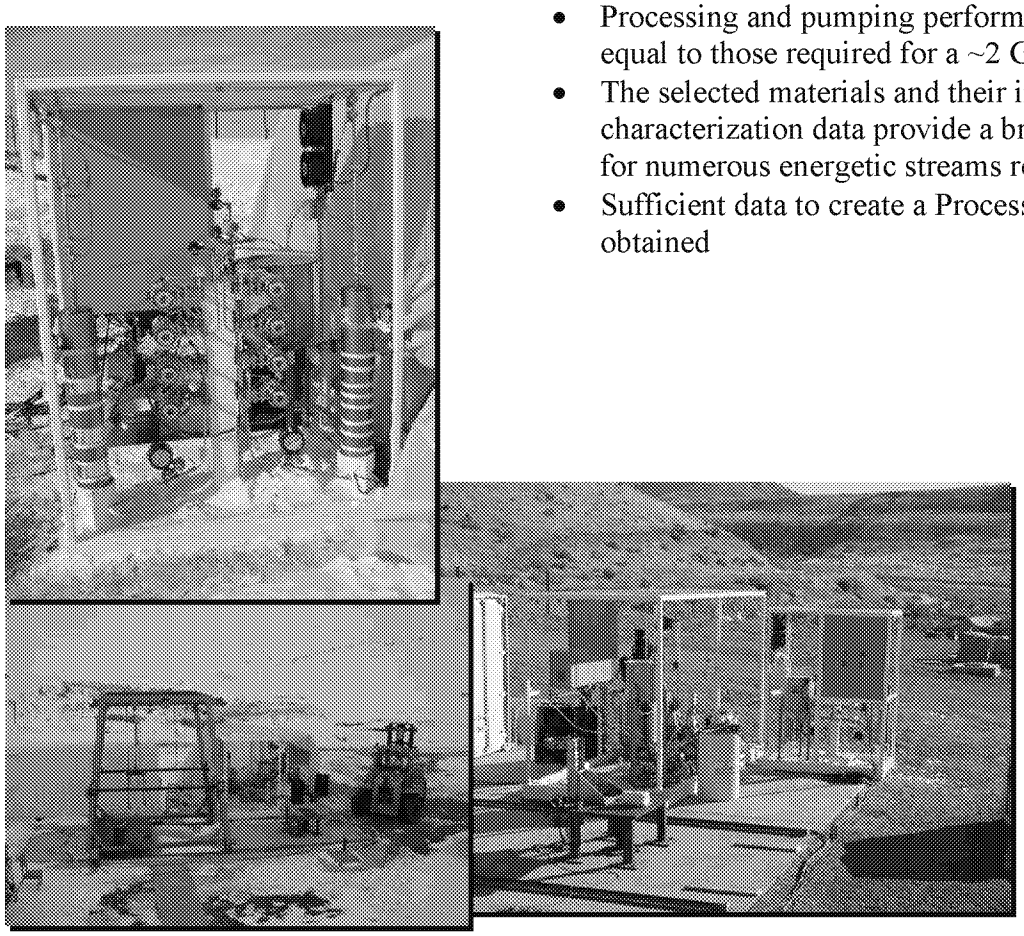
The energetic materials were selected based on their sensitivity, the likelihood of a "real world" application and their ability to "push the equipment and processing envelope. The slurries prepared for this program were: 25 wt% TNT/water, 20 wt% HMX/water and 20 wt% WC-872 (double base propellant)/water. The HMX and TNT slurries were pumped continuously at 4000 psig in a manner typical of what would be experienced in a SCWO processing environment for 46 hrs and 70 hrs respectively. All operations were performed outdoors in extreme weather conditions without incident.

Successful direct processing and pumping of energetic containing wastes eliminates preprocessing steps intended to reduce or eliminate the potential of initiation or detonation. The ability to direct pump these streams will improve processing economics and broaden the market for SCWO technology. The successfully completed program demonstrates that equipment designs, concepts and procedures can be safely implemented to create high concentration energetic slurries of the proper particle size and rheology and that those slurries can be reliably pumped to pressures suitable for SCWO processing.



Raw Energetic Materials

- Testing utilized real world, downloaded energetic materials
- All equipment self contained and skid mounted for easy transport
- Processing and pumping performed at throughput rates equal to those required for a ~2 GPM SCWO system
- The selected materials and their in-process characterization data provide a broad range of coverage for numerous energetic streams requiring demil
- Sufficient data to create a Process Hazards Analysis obtained



Slurry Grinding/Processing and Pumping Equipment at Test Site